WHAT IS CLAIMED IS:

1. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a diffraction unit receiving a beam emitted from the light source to generate a plurality of diffracted beams composed of a 0th order diffracted light beam and a 1st or higher order diffracted light beam;

a condensing unit receiving the plurality of diffracted beams from the diffraction unit and condensing the beams onto an optical recording medium;

a beam splitter receiving the plurality of beams reflected from the optical recording medium and splitting the beams; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams,

wherein the 0th order diffracted light beam generated in the diffraction unit is set to be a main beam, and two 1st or higher order diffracted light beams generated in the diffraction unit are set to be a first sub-beam and a second sub-beam,

the photodetector has a plurality of light-receiving portions, and

the main beam, the first sub-beam, and the second sub-beam are received by the plurality of light-receiving portions, respectively; and

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam,

wherein the optical recording medium has tracks arranged substantially at a constant pitch,

an average of the pitch is tp,

when the main beam is placed on the track, the first sub-beam and the second sub-beam are placed between the tracks,

the tracking error signal generator performs a differential arithmetic operation with respect to signals output from the light-receiving portion receiving the main beam to generate a first push-pull signal, performs a differential arithmetic operation with respect to signals output from the light-receiving portions receiving the first sub-beam and the second sub-beam to generate a second push-pull signal, and performs a differential arithmetic

operation with respect to the first push-pull signal and the second push-pull signal to generate the tracking error signal, in a case where an amplitude of the first push-pull signal obtained at the pitch tp is fluctuated when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium.

2. The optical information apparatus according to claim 1, wherein the first push-pull signal is generated without using a region in a vicinity of a center of the main beam, and the second push-pull signal is generated without using regions in a vicinity of centers of the first sub-beam and the second sub-beam.

3. The optical information apparatus according to claim 1, further comprising a spherical aberration error signal generator generating a spherical aberration error signal representing a spherical aberration amount of a beam condensed onto the optical recording medium,

wherein the spherical aberration error signal generator performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of a center of the main beam to generate a first focus error signal, performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of an outer side of the main beam to generate a second focus error signal, and performs a differential arithmetic operation of the first focus error signal and the second focus error signal to obtain the spherical aberration error signal.

4. The optical information apparatus according to claim 1, wherein the main beam, the first sub-beam, and the second sub-beam are received by four light-receiving portions, respectively, and

the first push-pull signal and the second push-pull signal are obtained by an arithmetic operation $(I1 - I2) - k \cdot (I3 - I4)$ where I1 to I4 are outputs from the four light-receiving portions receiving the main beam, the first sub-beam, and the second sub-beam, respectively, and k is a real number.

5. The optical information apparatus according to claim 4, further comprising a spherical aberration error signal generator generating a spherical aberration error signal representing a spherical aberration amount

of a beam condensed onto the optical recording medium,

wherein the spherical aberration error signal generator performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of a center of the main beam to generate a first focus error signal, performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of an outer side of the main beam to generate a second focus error signal, and performs a differential arithmetic operation of the first focus error signal and the second focus error signal to obtain the spherical aberration error signal.

6. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

wherein the photodetector has a plurality of light-receiving portions, and

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam,

wherein the optical recording medium has tracks arranged substantially at a constant pitch,

an average of the pitch is tp,

the beams are received by the plurality of light-receiving portions, and

the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal, and in a case where an amplitude of the push-pull signal, obtained at a pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium, is changed at a pitch different from the pitch tp, the push-pull signal is obtained by an arithmetic operation $(I1 - I2) - k \cdot (I3 - I4)$ where I1 to I4 are the outputs from

four light-receiving portions receiving the beams and k is a real number.

7. The optical information apparatus according to claim 6, further comprising a spherical aberration error signal generator generating a spherical aberration error signal representing a spherical aberration amount of a beam condensed onto the optical recording medium,

wherein the optical recording medium has tracks arranged substantially at a constant pitch,

an average of the pitch is tp,

the spherical aberration error signal generator performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of a center of the main beam to generate a first focus error signal, performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of an outer side of the main beam to generate a second focus error signal, and performs a differential arithmetic operation of the first focus error signal and the second focus error signal to obtain the spherical aberration error signal.

8. The optical information apparatus according to claim 6, wherein the tracking error signal generator generates the push-pull signal without using the region in the vicinity of the center of the beam.

9. The optical information apparatus according to claim 8, further comprising a spherical aberration error signal generator generating a spherical aberration error signal representing a spherical aberration amount of a beam condensed onto the optical recording medium,

wherein the optical recording medium has tracks arranged substantially at a constant pitch,

an average of the pitch is tp,

the spherical aberration error signal generator performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of a center of the main beam to generate a first focus error signal, performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of an outer side of the main beam to generate a second focus error signal, and performs a differential arithmetic operation of

the first focus error signal and the second focus error signal to obtain the spherical aberration error signal.

10. The optical information apparatus according to any one of claims 8 to 9, wherein light passing through a region containing a large amount of 1st order diffracted light diffracted by the tracks of the optical recording medium is received by the light-receiving portions, whereby the outputs I1 and I2 are output from the light-receiving portions,

light passing through a region containing almost no 1st order diffracted light diffracted by the tracks of the optical recording medium is received by the light-receiving portions, the outputs I3 and I4 are output from the light-receiving portions, and

in an image of the beam condensed on the condensing unit, assuming that a distance of the region in the vicinity of the center of the beam that is not used for generating the push-pull signal from a center of the condensing unit is L1 and a minimum distance of the 1st order diffracted light diffracted by the tracks of the optical recording medium from the center of the condensing unit is L2, light having passed through a region between the distance L1 and the distance L2 is received by the light-receiving portions, whereby the outputs I3 and I4 are output from the light-receiving portions.

11. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

wherein the photodetector has a plurality of light-receiving portions, and

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam,

wherein the optical recording medium has tracks arranged substantially at a constant pitch,

an average of the pitch is tp,

the beams are received by the plurality of light-receiving portions, and

the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal, and in a case where an amplitude of the push-pull signal, obtained at a pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium, is changed at a pitch different from the pitch tp, the push-pull signal is generated without using a region in a vicinity of a center of the beam,

the optical information apparatus further comprising a spherical aberration error signal generator generating a spherical aberration error signal representing a spherical aberration amount of a beam condensed on the optical recording medium,

the spherical aberration error signal generator performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of a center of the main beam to generate a first focus error signal, performs a differential arithmetic operation of the signals output from the plurality of light-receiving portions receiving a region in a vicinity of an outer side of the main beam to generate a second focus error signal, and performs a differential arithmetic operation of the first focus error signal and the second focus error signal to obtain the spherical aberration error signal.

12. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

wherein the photodetector has a plurality of light-receiving portions, and

a tracking error signal generator generating a tracking error signal

for irradiating a desired track with a beam,

wherein the optical recording medium has tracks arranged substantially at a constant pitch,

an average of the pitch is tp,

the beams are received by the plurality of light-receiving portions, and

the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal, and in a case where an amplitude of the push-pull signal, obtained at a pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium, is changed at a pitch different from the pitch tp, the push-pull signal is generated without using a region in a vicinity of a center of the beam.

13. The optical information apparatus according to any one of claims 8, 11, and 12, wherein in an image of the beam condensed on the condensing unit, the region in the vicinity of the center of the beam that is not used for generating the push-pull signal forms a shape symmetrical with respect to a segment parallel to the image of the tracks in the condensing unit.

14. The optical information apparatus according to claim 13, wherein in the image of the beam condensed on the condensing unit, the region in the vicinity of the center of the beam that is not used for generating the push-pull signal has a rectangular shape.

15. The optical information apparatus according to claim 13, wherein in the image of the beam condensed on the condensing unit, the region in the vicinity of the center of the beam that is not used for generating the push-pull signal has a square shape.

16. The optical information apparatus according to claim 13, wherein in the image of the beam condensed on the condensing unit, the region in the vicinity of the center of the beam that is not used for generating the push-pull signal has a spiral shape.

17. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

wherein the photodetector has a plurality of light-receiving portions,

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam;

a focus error signal generator generating a focus error signal for irradiating a desired focus position with a beam;

a recording/non-recording detector detecting whether or not information is recorded at a position of the beam condensed on the optical recording medium; and

an amplitude controller controlling an amplitude of the tracking error signal with a coefficient k,

wherein the amplitude controller is controlled by using a signal generated from the recording/non-recording detector and a signal generated from the focus error signal generator.

18. The optical information apparatus according to claim 17, wherein the recording/non-recording detector detects an amplitude of a signal varied depending upon a mark and a space recorded on the optical recording medium and a signal with a low frequency component obtained by a low-pass filter from a signal output from the photodetector, thereby detecting whether or not information is recorded at a position of the beam condensed on the optical recording medium.

19. The optical information apparatus according to any one of claims 4, 6, and 17, wherein k is set so that a change amount of the amplitude is minimum in a case where the amplitude of the push-pull signal, obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium, is changed at a pitch different from the pitch tp,

20. The optical information apparatus according to any one of claims 4, 6, and 17, wherein *k* is set so that a position of a light beam, where the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is a substantially zero-intersection point, is close to a center of the track.

21. The optical information apparatus according to any one of claims 4, 6, and 17, wherein assuming that k1 is a value of *k* for minimizing a change amount in a case where the amplitude of the push-pull signal, obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium, is changed at a pitch different from the pitch tp, and k2 is a value of k in a case where a position of a light beam, where the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is a substantially zero-intersection point, is closest to a center of the track, k is set to be a value between k1 and k2.

22. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

wherein the photodetector has a plurality of light-receiving portions,

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam;

wherein the optical recording medium has an information recording surface for recording information,

the optical recording medium has a reflective surface for reflecting the beam when the beam is condensed onto the information recording surface,

the beam splitter has a plurality of regions, a size of the beam on the beam splitter is D, a numerical aperture of the condensing unit is NA, a lateral multiplication of an optical system in the optical pick-up head from the optical recording medium to the photodetector is α, an interval between the information recording surface and the reflective surface is d, and a refractive index present in the interval d between the information recording surface and the reflective surface is n2,

the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal, and

when the beam splitter splits the beam in a direction different from that of the light-receiving portion outputting a signal for generating the tracking error signal over a width h of a region in a vicinity of a center to be irradiated with the beam, a width S of the light-receiving portion outputting a signal for generating the tracking error signal has a relationship $S \leq 2 \cdot h \cdot \alpha \cdot NA \cdot d/(D \cdot n2)$.

23. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

wherein the photodetector has a plurality of light-receiving portions,

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam;

wherein the optical recording medium has an information recording surface for recording information,

the optical recording medium has a reflective surface for reflecting the beam when the beam is condensed onto the information recording surface,

the tracking error signal generator performs a differential arithmetic

operation with respect to the signals output from the light-receiving portions to generate a push-pull signal, and

the beam splitter has five regions, and splits the beam in a direction different from that of the light-receiving portion outputting a signal for generating the tracking error signal over a width h of a region in a vicinity of a center to be irradiated with the beam and splits the beam in the substantially same direction in the other four regions.

24. The optical information apparatus according to any one of claims 22 to 23, wherein the condensing unit is driven in accordance with tracking control, and

the beam splitter splits the beam in a direction substantially orthogonal to a direction in which an image on the light-receiving portion is moved when the condensing unit is driven, and the tracking error signal is generated with the split beams.

25. The optical information apparatus according to any one of claims 22 and 23, wherein the beams split from the plurality of regions in the beam splitter are received by the plurality of light-receiving portions substantially adjacent to each other.

26. The optical information apparatus according to claim 25, wherein the beams split by first and second regions of the beam splitter contain a large amount of 1st order diffracted light diffracted by the tracks of the optical recording medium,

the beams split by third and fourth regions of the beam splitter contain almost no 1st order diffracted light diffracted by the tracks of the optical recording medium, and

a first virtual segment on the photodetector connecting the beam split by the first region to the beam split by the second region, and a second virtual segment on the photodetector connecting the beam split by the third region to the beam split by the fourth region are orthogonal to an image of the tracks on the photodetector, respectively.

27. The optical information apparatus according to claim 25, wherein an outline of the plurality of light-receiving portions substantially adjacent to each other is a rectangle.

28. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

wherein the photodetector has a plurality of light-receiving portions,

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam;

wherein the optical recording medium has an information recording surface for recording information,

the optical recording medium has a reflective surface for reflecting the beam when the beam is condensed onto the information recording surface,

the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal, and

the beam splitter has five different regions, and splits the beam in a direction different from that of the light-receiving portion outputting a signal for generating the tracking error signal over a width h of a region in a vicinity of a center to be irradiated with the beam and splits the beam in the substantially same direction in the other four regions,

the photodetector has five light-receiving portions at positions close to each other,

each of the beams split by the other four regions of the beam splitter is received one light-receiving portion, and

the tracking error signal generator obtains the push-pull signal by an arithmetic operation $\{(I1 - I5) - k1 \cdot (I2 - I5)\} - k \cdot \{(I3 - I5) - k2 \cdot (I4 - I5)\}$, where I1 to I4 are signals output from the four light-receiving portions receiving the beams split by the other four regions of the beam splitter, I5 is a signal output from the light-receiving portion provided close to the four

light-receiving portions receiving the beams split by the beam splitter, and k is a real number.

29. The optical information apparatus according to any one of claims 22, 23, and 28, wherein the beams split by the beam splitter are substantially focused on the light-receiving portion.

30. The optical information apparatus according to any one of claims 22, 23, and 28, wherein the light-receiving portion outputting a signal for detecting the focus error signal is integrated with the light-receiving portion outputting a signal for detecting the tracking error signal.

31. The optical information apparatus according to any one of claims 22, 23, and 28, wherein the optical pick-up head further includes an astigmatism generator that provides a beam with astigmatism in an optical path from the optical recording medium to the photodetector, and the focus error signal is detected based on the beam provided with the astigmatism.

32. The optical information apparatus according to claim 31, wherein the beam splitter provides a beam to be split with a wave front for canceling the astigmatism provided to the beam by the astigmatism generator.

33. The optical information apparatus according to any one of claims 2, 6, 11, 12, 17, 22, 23, and 28, wherein the region in the vicinity of the center of the beam that is not used for generating the push-pull signal corresponds to a region where the 0th order diffracted light and the first order diffracted light, which are reflected and diffracted by the optical recording medium, are not overlapped with each other.

34. The optical information apparatus according to any one of claims 2, 6, 11, 12, 17, 22, 23, and 28, wherein the plurality of light-receiving portions respectively receive a beam partially, thereby splitting the beam.

35. The optical information apparatus according to any one of claims 2, 6, 11, 12, 17, 22, 23, and 28, wherein the beam is split by providing the beam splitter in an optical path from the optical recording medium to the photodetector.

36. The optical information apparatus according to any one of claims 1, 6, 11, 12, 17, 22, 23, and 28, wherein the amplitude of the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is changed at a pitch different from the pitch tp, in a region where a track in which information is not recorded is adjacent to a track in which information is recorded.

37. The optical information apparatus according to any one of claims 1, 6, 11, 12, 17, 22, 23, and 28, wherein the amplitude of the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is changed at a pitch different from the pitch tp, by fluctuation in a pitch formed on the optical recording medium.

38. The optical information apparatus according to any one of claims 1, 6, 11, 12, 17, 22, 23, and 28, wherein the amplitude of the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is changed at a pitch different from the pitch tp, by fluctuation in a track width formed on the optical recording medium.

39. The optical information apparatus according to any one of claims 1, 6, 11, 12, 17, 22, 23, and 28, wherein the amplitude of the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is changed at a pitch different from the pitch tp, by fluctuation in a track depth formed on the optical recording medium.

40. The optical information apparatus according to claim 1, wherein assuming that tracks irradiated with the main beam when the main beam is scanned in a direction orthogonal to the tracks are Tn−1, Tn, and Tn+1, and when the main beam is placed at a center of the track Tn, the first sub-beam is placed between the tracks Tn−1 and Tn, and the second sub-beam is placed between the tracks Tn and Tn+1.

41. The optical information apparatus according to claim 1, wherein assuming that tracks irradiated with the main beam when the main beam is

scanned in a direction orthogonal to the tracks are Tn–2, Tn–1, Tn, Tn+1, and Tn+2, and when the main beam is placed at a center of the track Tn, the first sub-beam is placed between the tracks Tn–2 and Tn–1, and the second sub-beam is placed between the tracks Tn+1 and Tn+2.

42. The optical information apparatus according to any one of claims 1, 6, 11, 12, 17, 22, and 23, wherein a relationship $tp/0.8 < \lambda/NA < 0.5$ μm is satisfied, where λ is a wavelength of the light source, and NA is a numerical aperture of the condensing unit.

43. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

wherein the photodetector has a plurality of light-receiving portions,

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam;

wherein the optical recording medium has an information recording surface for recording information,

the optical recording medium has a reflective surface for reflecting the beam when the beam is condensed onto the information recording surface, and

the light-receiving portions are placed so that the beam reflected from the reflective surface when the beam is condensed onto the information recording surface is not incident upon the light-receiving portions.

44. The optical information apparatus according to claim 43, wherein the reflective surface for reflecting the beam when the beam is condensed onto the information recording surface is a second information recording surface.

45. The optical information apparatus according to claim 36, wherein the reflective surface for reflecting the beam when the beam is condensed onto the information recording surface is a beam incident surface of the optical recording medium.

46. The optical information apparatus according to any one of claims 1, 6, 11, 12, 17, 22, 23, and 28, wherein the light-receiving portion receiving a beam used for generating the tracking error signal is smaller than the light-receiving portions receiving the other beams.

47. The optical information apparatus according to any one of claims 1, 6, 11, 12, 17, 22, 23, and 28, wherein the optical recording medium has a plurality of information recording surfaces.

48. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a spherical aberration providing unit providing the beam with spherical aberration;

a condensing unit receiving the beam from the spherical aberration providing unit and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam;

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams; and

a driving unit driving the condensing unit to enable tracking control to be performed,

wherein the photodetector has a plurality of light-receiving portions,

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam; and

an offset compensating unit compensating an offset occurring in the tracking error signal in accordance with a position of the condensing unit driven by the driving unit,

wherein the spherical aberration providing unit is capable of

adjusting spherical aberration provided to the beam in accordance with a state of the beam condensed on the optical recording medium, and

the offset compensating unit is controlled in accordance with the spherical aberration provided by the spherical aberration providing unit.

49. An optical information apparatus, comprising:

a light source emitting a light beam;

a condensing unit condensing the light beam emitted from the light source onto an optical recording medium having a track;

a splitter splitting the light beam reflected/diffracted from the optical recording medium;

a divider dividing the split light beams into a plurality of regions;

a photodetector having a plurality of detection regions detecting light beams divided by the divider and outputting current signals in accordance with amounts of the detected light beams;

a plurality of converters converting the current signal output from the photodetector to voltage signals; and

a tracking error signal generator generating a tracking error signal by subtracting a voltage signal obtained from a second region multiplied by a coefficient from a voltage signal obtained from a first region, where among the plurality of regions placed in the divider, a region mainly containing a tracking error signal component is set to be the first region, and a region mainly containing an offset component of a tracking error signal is set to be the second region,

wherein an efficiency at which a light beam having passed through the second region reaches the photodetector is higher than an efficiency at which a light beam having passed through the first region reaches the photodetector.

50. An optical information apparatus, comprising:

a light source emitting a light beam;

a condensing unit condensing the light beam emitted from the light source onto an optical recording medium having a track;

a splitter splitting the light beam reflected/diffracted from the optical recording medium;

a divider dividing the split light beams into a plurality of regions;

a photodetector having a plurality of detection regions detecting light

beams split by the splitter and outputting current signals in accordance with amounts of the detected light beams;

a plurality of converters converting the current signal output from the photodetector to voltage signals; and

a tracking error signal generator generating a tracking error signal by converting a current signal obtained from a light beam having passed through the first region and a current signal obtained from a light beam having passed through the second region to voltages by an identical converter, where among the plurality of regions placed in the divider, a region mainly containing a tracking error signal component is set to be the first region, and a region mainly containing an offset component of a tracking error signal is set to be the second region.

51. The optical information apparatus according to claim 50, wherein an efficiency at which a light beam having passed through the second region reaches the photodetector is higher than an efficiency at which a light beam having passed through the first region reaches the photodetector.

52. The optical information apparatus according to claim 49 or 50, wherein an efficiency at which a part of a light beam having passed through the second region reaches the photodetector is higher than an efficiency at which a light beam having passed through the first region reaches the photodetector.

53. The optical information apparatus according to claim 49 or 50, wherein an efficiency at which a light beam having passed through an outer circumferential portion of the second region reaches the photodetector is high.

54. The optical information apparatus according to claim 49 or 50, wherein an efficiency at which a light beam having passed through a circumferential portion in a track tangent direction of the second region reaches the photodetector is high.

55. The optical information apparatus according to claim 49 or 50, wherein an efficiency at which a light beam having passed through a circumferential portion in a direction traversing a track in the second region reaches the photodetector is high.

56. The optical information apparatus according to claim 50, wherein the photodetector includes at least first to fourth detection regions,

the first region is divided into at least four regions by a dividing line substantially parallel to a track tangent direction and a dividing line substantially parallel to a direction orthogonal to the tracks,

the second region is divided into at least four regions by a dividing line substantially parallel to a track tangent direction and a dividing line substantially parallel to a direction orthogonal to the tracks, and

light having passed through the second region is converted to a voltage signal by the converter converting a current signal obtained by receiving light having passed through regions in a diagonal direction of the first region.

57. The optical information apparatus according to claim 56, wherein the light having passed through the second region is condensed so as to be focused on the photodetector.

58. The optical information apparatus according to claim 56, wherein the light having passed through the first region is condensed so as to be focused on the photodetector.

59. The optical information apparatus according to claim 57, wherein a focus error signal and an information reproducing signal are generated based on the signals obtained by the photodetector having at least the first to fourth detection regions.

60. An optical information apparatus, comprising:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a light beam from the light source and condensing the light beam onto an optical recording medium;

a beam splitter splitting the light beam reflected/diffracted from the optical recording medium;

a divider dividing the light beams, split by the beam splitter, into a plurality of regions;

a photodetector receiving the light beams divided by the

divider and outputting signals in accordance with amounts of the received light beams;

a tracking error signal generator generating a tracking error signal for irradiating a desired track with the light beam; and

an information signal generator generating an information signal recorded on the optical recording medium,

wherein the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal,

the divider divides the light beam so as to generate the information signal and the push-pull signal,

the push-pull signal is generated based on signals from regions other than a region in a vicinity of a center of the light beam, and

a ratio of signals obtained from the region in the vicinity of the center of the light beam so as to generate the information signal is higher than a ratio of signals obtained from a region on a outer circumference side of the light beam.

61. The optical information apparatus according to claim 60, wherein the region in the vicinity of the center of the light beam among the plurality of regions of the divider has a rectangular shape.

62. The optical information apparatus according to any one of claims 35, 49, 50, and 60, wherein the divider is integrated with the condensing unit.

63. The optical information apparatus according to any one of claims 49 and 50, wherein the divider is a diffraction element, and

a difference in the reaching efficiency is caused based on a difference in a diffraction efficiency of the diffraction element.

64. An optical pick-up head, comprising:

a light source emitting a light beam;

a diffraction unit receiving the light beam emitted from the light source to generate a plurality of diffracted beams composed of a 0th order diffracted light beam and a 1st or higher order diffracted light beam;

a condensing unit receiving the plurality of diffracted beams from the diffraction unit and condensing the beams onto an optical recording medium;

a beam splitter receiving the plurality of beams reflected from the optical recording medium and splitting the beams; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams,

wherein the 0th order diffracted light beam generated in the diffraction unit is set to be a main beam, and two 1st or higher order diffracted light beams generated in the diffraction unit are set to be a first sub-beam and a second sub-beam, assuming that Tn−2, Tn−1, Tn, Tn+1, and Tn+2 represent tracks irradiated with the main beam when the main beam is scanned in a direction orthogonal to the tracks, and the main beam is placed at a center of the track Tn, the first sub-beam is placed between the tracks Tn−2 and Tn−1, and the second sub-beam is placed between the tracks Tn+1 and Tn+2.

65. An optical pick-up head, comprising:

a light source emitting a light beam;

a first condensing unit receiving the light beam from the light source and condensing the light beam onto a recording surface of an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam;

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams;

a beam divider dividing the beams split by the beam splitter into a plurality of beams so as to correspond to a plurality of light-receiving portions placed on the photodetector; and

a second condensing unit condensing the beam onto the photodetector,

wherein the optical recording medium has a reflective surface for reflecting the beam when the beam is condensed to the recording surface,

an opening limit member is provided between the first condensing unit and the second condensing unit, and

an outer circumference portion of the beam reflected from the reflective surface for reflecting the beam of the optical information recording medium is blocked against light so that the beam reflected from the reflective surface for reflecting the beam of the optical information recording medium is not incident upon the photodetector.

66. The optical pick-up head according to claim 65, wherein the reflective surface for reflecting the beam when the beam is condensed onto the recording surface is formed on a beam incident side with respect to the recording surface.

67. The optical pick-up head according to claim 65, wherein the reflective surface for reflecting the beam when the beam is condensed onto the recording surface is another recording surface of the optical recording medium.

68. The optical pick-up head according to claim 65, wherein the reflective surface for reflecting the beam when the beam is condensed onto the recording surface is a surface of the optical recording medium.

69. The optical pick-up head according to claim 65, wherein the opening limit member is provided in a vicinity of the beam divider.

70. The optical pick-up head according to claim 65, wherein the opening limit member is integrated with the beam divider.

71. The optical pick-up head according to claim 65, wherein even in a case where the condensing unit is displaced in a tracking direction of the optical recording medium, an opening of the opening limit member is larger in the tracking direction than in a direction orthogonal to the tracking direction, so as not to block light reflected from the recording surface of the optical recording medium.

72. An optical information apparatus, comprising:

the optical pick-up head of any one of claims 64 to 65;

a driving portion changing a relative position between the optical recording medium and the optical pick-up head; and

an electric signal processing portion receiving signals output from the optical pick-up head and performing a differential arithmetic operation to obtain desired information.

73. A method for reproducing optical information using

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a beam from the light source and condensing the beam onto an optical recording medium;

a beam splitter receiving the beam reflected from the optical recording medium and splitting the beam; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams, wherein the photodetector has a plurality of light-receiving portions, and

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam,

wherein the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal,

the optical recording medium has tracks arranged substantially at a constant pitch, and an average of the pitch is tp, and

when an amplitude of the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is changed at a pitch different from the pitch tp, the change in the amplitude of the push-pull signal is reduced by avoiding use of a partial region of the beam or manipulating a signal obtained from the partial region of the beam.

74. A method for reproducing optical information using

an optical pick-up head including:

a light source emitting a light beam;

a diffraction unit receiving the light beam emitted from the light source to generate a plurality of diffracted beams composed of a 0th order diffracted light beam and 1st or higher order diffracted light beams;

a condensing unit receiving the plurality of beams from the diffraction unit and condensing the beams onto an optical recording medium;

a beam splitter receiving the plurality of beams reflected from the optical recording medium and splitting the beams; and

a photodetector receiving the beams split by the beam splitter and outputting signals in accordance with amounts of the received light beams, and

a tracking error signal generator generating a tracking error signal for irradiating a desired track with a beam,

wherein the photodetector has a plurality of light-receiving portions,

the plurality of beams are radiated to positions different in a direction orthogonal to the tracks,

the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal,

the optical recording medium has tracks arranged substantially at a constant pitch, and an average of the pitch is tp, and

when an amplitude of the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is changed at a pitch different from the pitch tp, the change in the amplitude of the push-pull signal is reduced by manipulating a signal obtained from the plurality of beams.

75. The method for reproducing optical information according to any one of claims 73 and 74, wherein a track in which information is not recorded and a track in which information has been recorded are formed previously on the optical recording medium so that the amplitude of the push-pull signal obtained at the pitch tp when the light beam is scanned in a direction orthogonal to the tracks of the optical recording medium is changed at a pitch different from the pitch tp.

76. The method for reproducing optical information according to claim 75, wherein the track in which information has been recorded and the track in which information is not recorded are placed alternately.

77. A method for reproducing optical information using: a light source emitting a light beam; a condensing unit condensing the light beam emitted from the light source onto an optical recording medium having a track; a splitter splitting the light beam reflected/diffracted from the optical recording medium; a divider dividing the split light beams into a plurality of regions; a photodetector having a plurality of detection regions detecting light beams divided by the divider and outputting current signals in accordance with amounts of the detected light beams; a plurality of converters converting the current signal output from the photodetector to voltage signals; and a

tracking error signal generator generating a tracking error signal by subtracting a voltage signal obtained from a second region multiplied by a coefficient from a voltage signal obtained from a first region, where among the plurality of regions placed in the divider, a region mainly containing a tracking error signal component is set to be the first region, and a region mainly containing an offset component of a tracking error signal is set to be the second region,

wherein an efficiency, at which a light beam having passed through the second region reaches the photodetector, is higher than an efficiency at which a light beam having passed through the first region reaches the photodetector, whereby the offset component of the tracking error signal is reduced.

78. A method for reproducing optical information for reducing an offset of a tracking error signal by comprising: a light source emitting a light beam; a condensing unit condensing the light beam emitted from the light source onto an optical recording medium having a track; a splitter splitting the light beam reflected/diffracted from the optical recording medium; a divider dividing the split light beams into a plurality of regions; a photodetector having a plurality of detection regions detecting light beams divided by the divider and outputting current signals in accordance with amounts of the detected light beams; a plurality of converters converting the current signal output from the photodetector to voltage signals; and a tracking error signal generator generating a tracking error signal by converting a current signal obtained from a light beam of a first region and a current signal obtained from a light beam of the second region to voltages by an identical converter, where among the plurality of regions placed in the divider, a region mainly containing a tracking error signal component is set to be the first region, and a region mainly containing an offset component of a tracking error signal is set to be the second region,

79. A method for reproducing optical information using:

an optical pick-up head including:

a light source emitting a light beam;

a condensing unit receiving a light beam from the light source and condensing the light beam onto an optical recording medium;

a beam splitter splitting the light beam reflected/diffracted

from the optical recording medium;

a divider dividing the light beams, split by the beam splitter, into a plurality of regions;

a photodetector receiving the light beams divided by the divider and outputting signals in accordance with amounts of the received light beams;

a tracking error signal generator generating a tracking error signal for irradiating a desired track with the light beam; and

an information signal generator generating an information signal recorded on the optical recording medium,

wherein the tracking error signal generator performs a differential arithmetic operation with respect to the signals output from the light-receiving portions to generate a push-pull signal,

the divider divides the light beam so as to generate the information signal and the push-pull signal,

the push-pull signal is generated based on signals from regions other than a region in a vicinity of a center of the light beam, and

a ratio of information signals generated based on signals from the region in the vicinity of the light beam is set to be higher than a ratio of information signals generated based on signals from a region on an outer circumference side of the light beam, whereby information recorded on the optical recording medium is reproduced.